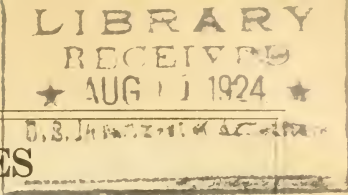


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KOREAN LESPEDEZA;
A NEW FORAGE CROP¹

A. J. PIETERS,

Agronomist in Charge of Clover Investigations, Office of Forage-Crop Investigations,
and

G. P. VAN ESELTINE,

Formerly Assistant Botanist, Office of Foreign Seed and Plant Introduction,
Bureau of Plant Industry

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INTRODUCTION AND EARLY TRIALS

A package of lespedeza seed was received by the Office of Foreign Seed and Plant Introduction in 1919 from Dr. Ralph G. Mills, of the Severance Union General Hospital at Seoul, Chosen (Korea), to which seed that office assigned the serial number 49027. This was seeded on the experiment farm of the United States Department of Agriculture at Arlington, Va., in 1921. As soon as the plants attained some growth it was evident that the material represented a species not before introduced into the United States. The plants grew more rapidly than those of Japanese lespedeza (*Lespedeza striata*) planted in an adjacent row, the leaflets were larger, the habit more open, and above all flowers appeared and seed was set some two weeks earlier than was the case with the plants of *L. striata* growing wild on the farm.

The early-blooming character seemed especially important, since it was at once realized that this might enable the new species to become naturalized far to the north of the range occupied by *Lespedeza striata*. It was believed that if it were possible to introduce

¹ *Lespedeza stipulacea*.
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upon the poorer lands of the Northeastern States a plant that would be as useful there as *L. striata* has long proved itself to be on similar land in the South, a valuable acquisition to the crops of this country would be secured.

With this end in view all the seed from the rod row planted was carefully saved, about 8 ounces being secured. It was thought that a maximum seed crop was more likely to be obtained in the South than as far north as Washington, D. C.; consequently most of the seed was sent to southern Mississippi for propagation and the remainder seeded in 18-inch rows at the Arlington Experiment Farm, Va. The hope of a large seed crop in the South, however, was not realized, only a few pounds being harvested in Mississippi, but at Arlington 240 pounds of seed were taken from a little less than one-fourth acre. It was clear that *Lespedeza stipulacea* is a northern

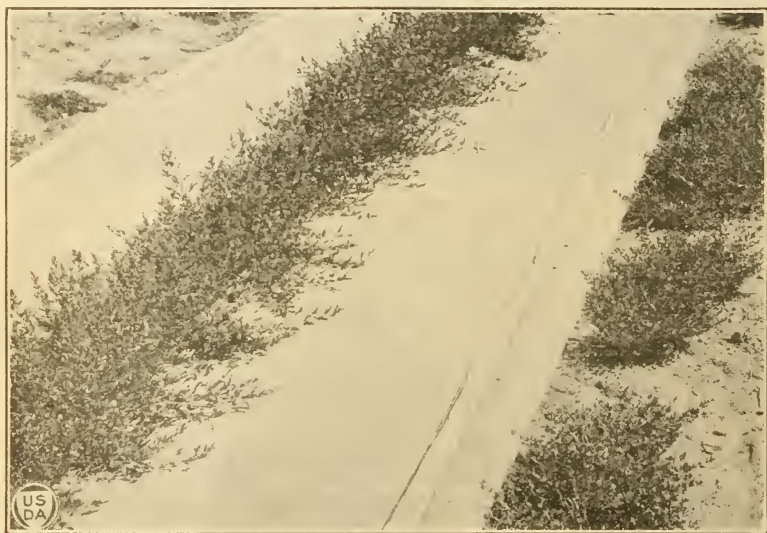


FIG. 1.—*Lespedeza stipulacea* (at left), showing habit of growth; at right, Tennessee selection No. 76 of *L. striata*. Arlington Experiment Farm, Va.

rather than a southern form, and in the spring of 1923 practically all the seed that had been obtained was sent for testing in the States north of the Ohio River. Out of the few ounces on hand in the spring of 1922 small quantities were sent to a few selected localities in order to learn as early as might be how far north this species would bear seed.

The present report is made in order to bring together the available information relating to the range, nature, and possible usefulness of *Lespedeza stipulacea*.

DESCRIPTION

The taxonomy of this species is given by the junior writer in the latter part of this circular. It is enough to say here that Korean lespedeza is a close relative of the common or Japanese lespedeza

already widely distributed in the Southern States, but differs from it in size, coarseness, and earliness as well as in the technical characters described below. Its earliness is believed to be a weakness so far as its use in the South is concerned. It seems probable that wherever *Lespedeza striata* will reproduce with certainty it will be the more valuable form, since *L. stipulacea* matures so early that in the latitude of Washington, D. C., it is ripe and dead at least a month before a killing frost and so produces no grazing at a time when *L. striata* is still green and fit to graze. On the other hand, the Korean starts earlier in the spring and grows more rapidly, thus furnishing grazing before the Japanese has attained sufficient size to be grazed. It is possible that at the higher altitudes in the South and at some other places the Korean may be of value either alone or in mixture with the Japanese.



FIG. 2.—Volunteer plant of *Lespedeza stipulacea* at Washington, D. C. This plant measured 3 feet 8 inches across on August 24, 1923

At present the indications are that the chief field of usefulness of the new introduction will be a zone roughly described as lying between southern Pennsylvania and northern Ohio on the north and the southern border of Virginia and Kentucky on the south, extending from the Atlantic coast to Iowa. It has also given promise in Kansas, on the eastern border of the Great Plains, but how far west it may prove valuable is not yet known.

HABIT OF THE PLANT

When grown so that each plant can spread freely Korean *lespedeza* forms a central stem and numerous spreading branches. The central stem of a vigorous plant may attain a height of 8 to 10 inches, while the lower laterals may be 15 to 20 inches long, giving the plant a spread of 3 feet or more (fig. 1.) Often the central stem is suppressed, as in Figure 2, which shows a large volunteer plant grown in 1923, or the central stem may become especially prominent,



FIG. 3.—Pot-grown plant of *Lespedeza stipulacea* at Washington, D. C. This plant measured 3 feet across and was 2 feet high on August 24, 1923

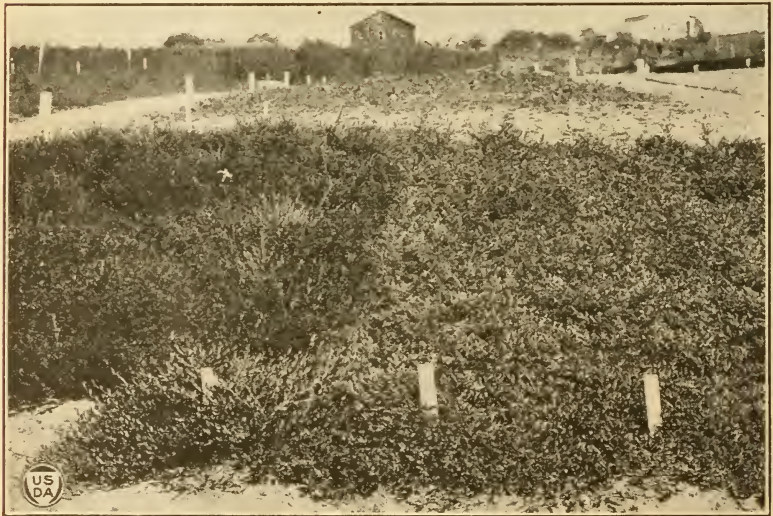


FIG. 4.—Plants of *Lespedeza stipulacea* (at right) seeded in rows 18 inches apart, completely covering the ground. Arlington Experiment Farm, Va.

as in Figure 3, a pot-grown specimen. When crowded, the growth is more ascending than when the plants have ample room. When

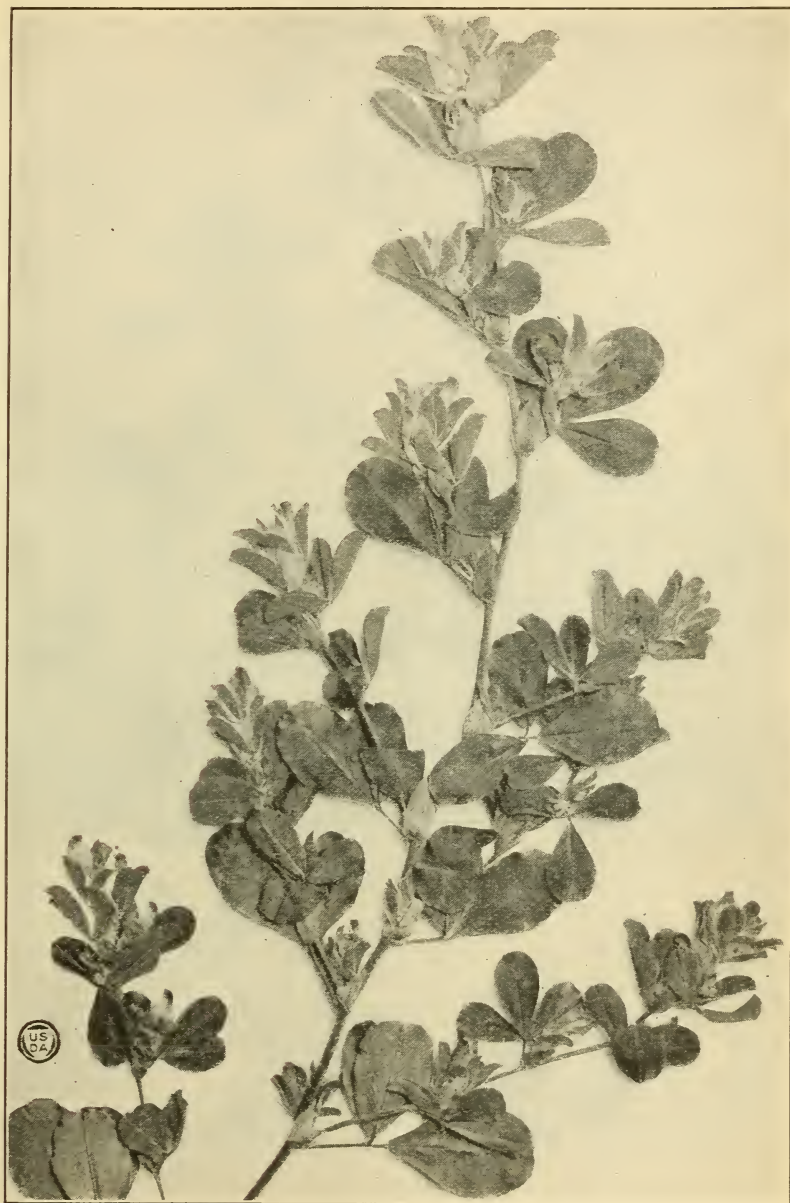


FIG. 5.—A branch of a plant of *Lespedeza stipulacea* grown at the Arlington Experiment Farm from the original seed sent in by Doctor Mills. Note, in comparison with Figure 6, the broader leaflets and stipules and the more hairy appearance of the young leaves. (Slightly enlarged)

grown in rows 18 inches apart the space between the rows is soon covered, and the entire field represents a heavy mat of foliage (fig. 4).

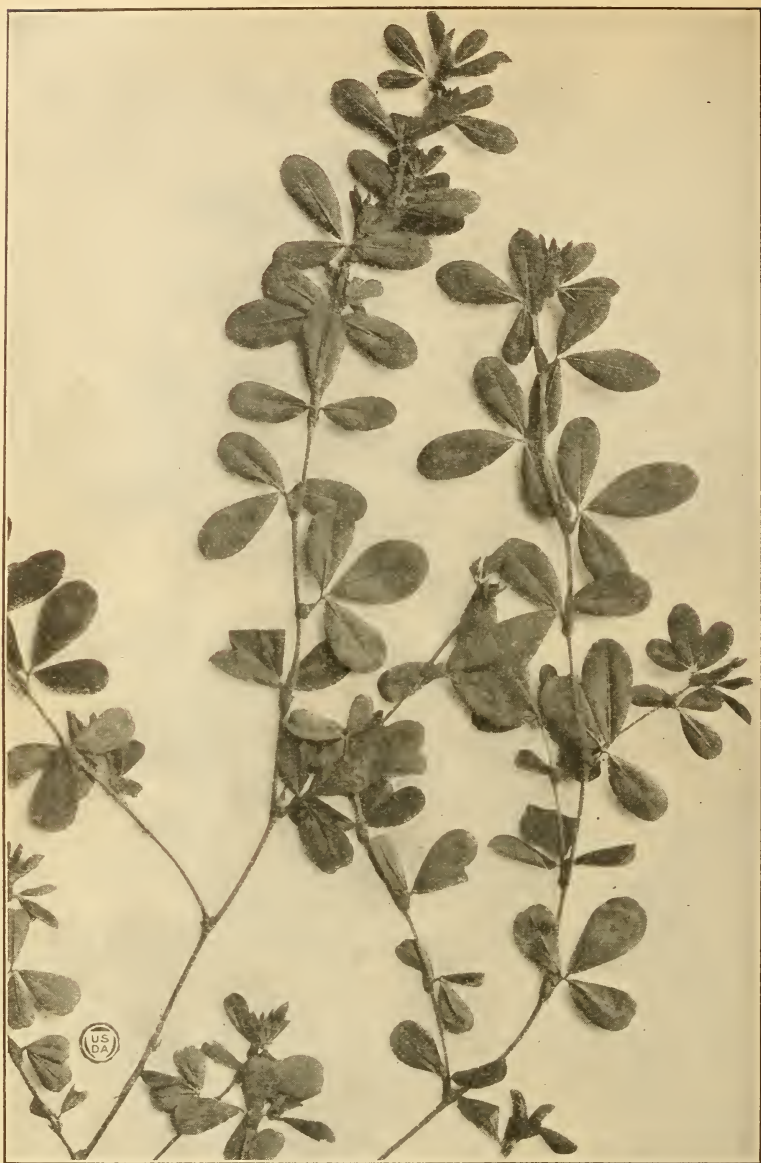


FIG. 6.—Branches of a plant of Japanese lespedeza (*Lespedeza striata*) found growing wild near the Arlington Experiment Farm. The lack of hairiness on the young leaves is fairly characteristic, but occasionally *L. striata* seems to be quite as hairy as *L. stipulacea* (Slightly enlarged)

As compared with the Japanese the growth is coarser, the branchlets more woody, and the leaflets decidedly larger, broader, and of a duller, grayer green (figs. 5 and 6).

SEEDING HABITS

Lespedeza stipulacea is a heavy seeder. No data are available as to how much seed may be expected from a crop grown on a field scale and without special attention. Every effort having been made to increase the seed supply as rapidly as possible, the plants have been grown in rows and the field has been hand-worked. The harvesting has been done by hand so that no seed should be lost. The yields at Arlington Experiment Farm, therefore, have been very much greater than could be expected under common farm conditions. In 1922, an area a little less than one-fourth of an acre where the rows were 18 inches apart yielded 240 pounds of clean seed.² In 1923 most of the area devoted to the crop was again seeded in rows 18 inches apart, but a smaller area was in rows 6 inches apart and another area in rows 3 inches apart. Though the two latter areas could not be hoed the weeds were pulled by hand. When ripe the plants were cut at the surface of the ground and carefully laid in small piles, from which they were hauled to the barn (fig. 7).



FIG. 7.—Harvesting the seed of Korean lespedeza at the Arlington Experiment Farm, Va., October, 1923

Threshing was done with a small grain thresher running at 1,200 revolutions per minute, with chaffer and wheat screen in the shaker and with the fan draft closed to keep the seed from blowing out with the straw. Even then some seed went over; the straw was run through the cleaner and a great deal of seed recovered. The total area devoted to seed increase was seven-eighths of an acre, and the total quantity of seed obtained was 880 pounds. A square rod was separately harvested from each of the areas planted in 3-inch and 6-inch rows, and these were threshed and cleaned separately by hand. The plants from the square rod of 6-inch row planting yielded 8 pounds and 2 ounces and those from the 3-inch row plantings yielded 10 pounds.

The seeds of Korean lespedeza are borne in the axils of the leaves on those parts of all branches and branchlets nearest the tip. They are borne one to three in a leaf axil, and as the seeds mature the

² Clean seed here means seed in the hull, as lespedeza seed is commonly sold.

leaves turn forward and overlap one another, thus making a cone-shaped tip to the branch or branchlet (fig. 8). These little conelike branch tips are heavily loaded with pods and seeds, and at maturity they constitute a character by which the Korean may be readily distinguished from the Japanese.

As compared with *Lespedeza striata* the pods of *L. stipulacea* are not readily seen. When a ripe branch of the Japanese is held



FIG. 8.—Ripe fruiting branches of *Lespedeza stipulacea* (at right) and of *L. striata* (at left). Note the conelike branch tips on the former. The seed is readily seen on the latter.

in the hand the pods are readily observed in all the branch axils, but on a branch of *L. stipulacea* the leaves do not fall readily, and so the pods are not conspicuous, being nearly all confined to the cone-like ends of the branchlets (fig. 8).

The flowers of the Korean are mostly inconspicuous, because in most of them the petals remain undeveloped. There are usually a few of the purplish flowers of pea-blossom shape, but on most flowers the

petals are reduced to minute scales that are pushed off by the growing ovary. On some plants the purple flowers may be quite numerous and on others few, while on some plants purple flowers do not occur. This feature leads the uninformed observer to conclude that the plants are not yet in bloom, while as a matter of fact seed may be freely set.

SEEDING RANGE

In 1922 small quantities of seed were distributed, in order that the seeding range of the species might be determined as early as possible. A larger distribution was made in 1923. The accompanying map (fig. 9) shows where the seed was sent, where the plants seeded, and roughly how well they produced seed. It will be noted that Lansing, Mich., and Corvallis, Oreg., are probably at the extreme northerly limit of seed setting. At Moscow, Idaho, at Astoria, Oreg., and at Ithaca, N. Y., no seed matured.

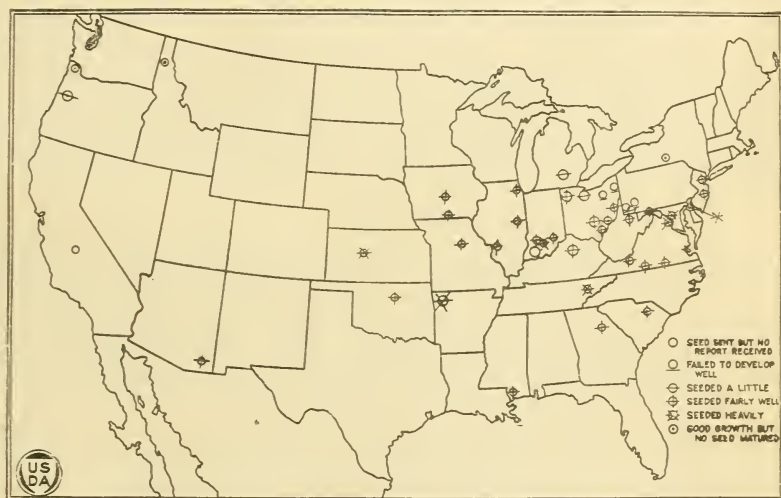


FIG. 9.—Outline map of the United States, showing the distribution for testing of seed of Korean lespedeza and its range of seeding.

It is evident that the production of seed does not depend wholly upon the number of days during which growth can be made or upon the extent of vegetative growth. At the Arlington Experiment Farm plants grown from seedlings made on July 17, 1923, were fairly well filled with seed on November 1, by which time they had made a growth of some 8 to 10 inches for the longest branches. At Hays, Kans., seedlings were made on May 17, and the plants were well podded on October 15, but were only 4 to 6 inches high. They had been cut to the ground by hail on June 29 and had been able to recover only after the rains of August 4, thus having a total growing time of only 72 days, or 151 days when reckoned from the time of seeding. At East Lansing seed was sown on April 27 and the plants collected on October 15, making a period of 171 days. The plants grew well and at the time of harvest were 14 inches high, with the longer branches 18 inches long, but they produced only a few ripe

seeds. It seems possible that the length of day may have a controlling influence, and this feature will be the subject of future study.

DROUGHT RESISTANCE

No special tests were made to determine the plant's resistance to drought, but at Hays, Kans., in Iowa, and at Stillwater, Okla., it was clear that the Korean lespedeza will withstand considerable drought. At Hays, Kans., the plants were cut down by hail at the end of June, but in spite of a dry July they survived and made a new growth after the rains came in August. In southeastern Iowa the plants displayed remarkable ability to grow during dry weather.³

VOLUNTEERING

Data at present are too few to permit generalization on volunteering, but Korean lespedeza volunteers freely at Arlington Experiment Farm, Va., and at Hicksville, Defiance County, Ohio, there was a good stand of volunteer plants in June, 1923, where a row of this species had been grown in 1922. At East Lansing, Mich., North Ridgeville, Ohio, and in New Jersey seed was sown on the snow or on the frozen ground in January and February, 1923, and good stands were obtained in the spring. It may be expected, therefore, that wherever plants will mature seed there will be a volunteer stand the following spring.

DISEASES

Lespedeza stipulacea seems to be more susceptible than *L. striata* to the attacks of *Sclerotium rolfsii*. At Arlington Experiment Farm that fungus always kills a small percentage of the plants, while it has not been noticed on plants of *L. striata*. At Athens, Ga., the Korean lespedeza suffered severely from some disease, possibly *Sclerotium rolfsii*, though this was not determined.

If the plants are finally found to be especially subject to attacks by this fungus, that fact will limit its usefulness in the South, though not in the North, where the fungus is not common.

SUMMARY

From reports received during 1923 and from observations made at Arlington Experiment Farm the following conclusions as to *Lespedeza stipulacea* may be tentatively drawn:

Korean lespedeza is considerably earlier than the Japanese lespedeza, producing a fair yield of seed as far north as Ames, Iowa.

It is coarser than the Japanese species and since it matures early is not so good a late-grazing crop wherever the latter is established. Possibly a mixture of the two may be desirable in the South. At the higher altitudes in the South the Korean should prove of value, since there the Japanese will not reseed.

Lespedeza stipulacea is quite drought resistant and deserves further trial on the eastern border of the Great Plains.

Korean is a heavy seeder, and in the neighborhood of Washington, D. C., a sure seeder. If the plant proves of as much value as seems at present possible, there should be no difficulty in supplying a demand for the seed.

³ See report from Prof. H. D. Hughes, page 11.

From the behavior of the Korean in southern Iowa it seems probable that it will thrive on relatively poor acid soils, and it certainly seems worthy of a trial under such conditions.

Trials in Ohio, where the seed was sown with a nurse crop, failed. The *lespedeza* seemed not as able as red clover to compete with the grain crop. However, in Illinois seeding with oats gave a good stand of plants 6 to 8 inches high in August.

When seeded on a heavy bluegrass pasture in western Pennsylvania, the *lespedeza* did not thrive; it could not compete with the bluegrass where this did well. However, when seeded on a poor bluegrass sod, as was done at Columbus, Ohio, the growth was satisfactory. The grass and *lespedeza* were cut in June, and during July and August the *lespedeza* outgrew the grass.

Korean *lespedeza* is a summer pasture crop for the poorer permanent pastures of the Northern States. It is not a hay crop and is not advised for any situations in which red clover, alsike clover, or sweet clover thrive. Its value is believed to lie in the fact that it will reseed the ground and will grow in the hot months when grass on poor droughty land is brown and dead.

EXTRACTS FROM REPORTS

In the main, the substance of reports received has been summarized above, but in some cases it seems worth while to quote more fully.

Prof. H. D. Hughes, Ames, Iowa, December, 1923.—*Lespedeza* was tested at three different points, one on the forage experimental field at Ames, where the soil is a rich black sandy loam. Here the plants made an unusually splendid growth. The seedings were made in rows 1 foot apart. The growth was so dense that the fact that it had been planted in rows could not be determined from casual observation. During a severe drought of three to four weeks the plants showed not the least injury, attracting the attention of everyone who had the opportunity to see them. We feared for a time that the plants would not mature seed, but through September and August a great many seeds were formed, and we are of the opinion that some of these are sufficiently mature to make plants next spring. * * * A second seeding was made in a pasture 2 miles south of Ames, where for some reason the grass had failed to grow. Seedings were made of *lespedeza*, Ladino clover, and white Dutch clover. A good stand was obtained of all three, but it was not long before the white clover and Ladino clover had entirely disappeared. The *lespedeza* made a very good stand, but was kept short by cattle pasturing upon it.

The third and by far the most important test was made on a very infertile washed soil very susceptible to drought and requiring $3\frac{1}{2}$ tons of lime to correct the acid. This soil is located 1 mile north of Corydon, Wayne County, Iowa. Here the *lespedeza* made almost as good a growth as on the rich black loam at Ames. One of the most notable characters of the legume is its strong root growth and value in preventing soil erosion. Heavy rains early in the spring washed this hillside very badly. The *lespedeza* even in its early stages of growth was found to make an unusual root development, and when practically the whole root system was exposed to the drying sun the plants retained their places and continued to grow vigorously. A severe drought during the month of July apparently had no effect on the legume even on an exposed hillside on a soil which had practically no organic matter in it. This test also gave us the idea of the value of this legume on distinctly acid soils. The lime requirement was $3\frac{1}{2}$ tons to correct the acid on the surface 7 inches. [No lime was applied.] On September 20 a great many seeds were observed to have formed. None of these were mature at that date, but we feel very confident that a very heavy setting of mature seed was secured and that the plants will reproduce themselves without difficulty in this section. The season has been very unfavorable to the maturing of crops. * * * We regard this *lespedeza* as one of the most promising crops which has come to our attention in recent years. Farmers and county agents who saw this legume growing in southern Iowa are anxious to have tests extended and to procure seed for planting on their own farms at the first opportunity.

A. D. McNair, Fayetteville, Ark., September 6, 1923.—In the agronomy department on the experiment-station farm they planted four rows of the new lespedeza perhaps 40 feet long each, and they also planted the same number of rows of Tennessee No. 76,⁴ both varieties being planted about the middle of May. * * * The Korean lespedeza in the agronomy department is about twice the size of the Tennessee No. 76 and is in full bloom at the present time, whereas Tennessee No. 76 has not even commenced to bloom. The lespedeza which I planted on March 30, April 7, and April 14 commenced to bloom about the middle of July. Some of it is still in bloom, but most of it is past the blooming stage. * * * There is no question about the superiority of Korean lespedeza over the common kind, and there is no doubt that it matures very much earlier, but how much earlier I can not exactly say. September 16.—A month ago the Korean lespedeza planted the middle of May was twice as large as the Tennessee No. 76, but at the present time there is not much difference in size. This is due, I presume, to the early flowering of the one and the late flowering of the other.

Sidney Johnson, Boynton, Va., August 3, 1923.—After the weather permitted us to sow the seed a very dry season set in; in fact, May and June were the driest I ever saw for the season. I did not expect the seed to come up, but it did. I gave lespedeza a thin sowing, as I wanted to cover as much land as I could. To-day this lespedeza looks grand, and I am very enthusiastic about it. * * * The roots are over 8 inches deep and have bacteria on them. As a pasture I think it is simply great. This is growing on land that has never seen limestone and on land that would make about 25 bushels of corn per acre—poor land and absolutely no fertilizer of any kind.

BOTANICAL HISTORY

The following notes on the botanical history and the taxonomy of Korean lespedeza were prepared by G. P. Van Eseltine, formerly Assistant Botanist, Office of Foreign Seed and Plant Introduction.

A study of this plant with other specimens in the National Herbarium and a search through the taxonomic literature dealing with lespedezas brought out the fact that two distinct species of similar range in Asia are involved.

The first to be named, *Lespedeza striata*, was originally described by Thunberg⁵ as *Hedysarum striatum* in 1784, was doubtfully referred to the genus *Desmodium* by De Candolle⁶ in 1825, and was transferred to the genus *Lespedeza* by Hooker and Arnott⁷ in 1840. Recently Schindler⁸ based his new genus, *Kummerowia*, on what he called *L. striata* (although to judge from his description he seems to have had in hand specimens of *L. stipulacea*), on the ground that in the genus *Lespedeza* the column of stamens persists, adhering to the receptacle of the perfect flowers, and where present the very minute petals of the imperfect flowers are found persisting around the mature fruit, while in *Kummerowia* the column falls with the petals, and the petals of the imperfect flowers are raised from the receptacle and persist for a time on the apex of the fruit. These characters, however, in the opinion of the writer, are scarcely of generic value.

The other species (*Lespedeza stipulacea*) was first described in 1859 by Maximowicz,⁹ but later, in 1873, was reduced to synonymy with

⁴ This is an improved strain of *Lespedeza striata* developed at the University of Tennessee.

⁵ Thunberg, K. P. *Flora japonica* . . . p. 289. Lipsiae, 1784.

⁶ Candolle, A. P. de. *Prodromus systematis naturalis regni vegetabilis*. Pars. 2, p. 337. Parisii, 1825.

⁷ Hooker, W. J., and G. A. W. Arnott. *The botany of Captain Beechey's voyage* . . . p. 262. London, 1841. [1830-1841]

⁸ Schindler, A. K. *Kummerowia Schindler novum genus Leguminosarum*. (Original diagnosis.) *In* *Repert. Spec. Nov. Regni Veg.*, fasc. 10, p. 403-404. 1912.

⁹ Maksimovich, K. I. (Maximowicz, C. I.) *Primitiae florae anurenensis*, p. 85. St. Petersburg, 1859.

— Synopsis generis *Lespedezae*, Michaux, *In* *Acta Horti Petropolitani*, t. 2, p. 382. 1873.

L. striata. Western botanists have generally followed Maximowicz in considering this species invalid.

In 1876, however, Debeaux¹⁰ recognized the plant as differing from *Lespedeza striata* and published it as variety *stipulacea* of that species, and in 1914 Makino¹¹ again raised it to species rank as *Kummerowia stipulacea*.

LESPEDEZA STIPULACEA IN JAPAN

In Japan the plants have been recognized as distinct for the last 35 years at least, and have been known by different common names—yahazuso (*Lespedeza striata*) and maruba-yahazuso (*L. stipulacea*). A note by Doctor Makino¹¹ in the Botanical Magazine of Tokyo gives the history of the common Japanese name for *L. stipulacea*.

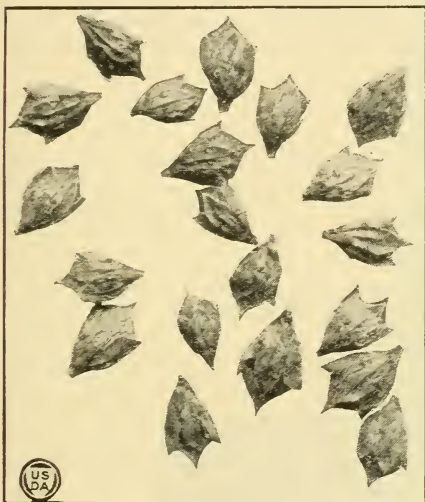


FIG. 10.—Pods of Japanese lespedeza (*Lespedeza striata*) with the calyxes still adhering. Note, in comparison with Figure 11, the large proportion of pod covered by the calyx and also the sharper pointed calyx lobes. (Magnified 4 diameters)

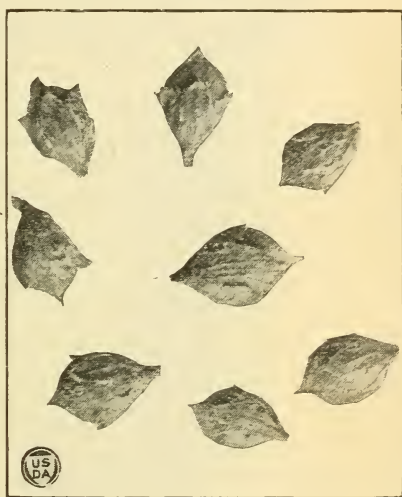


FIG. 11.—Pods of *Lespedeza stipulacea*, part of the original shipment from Doctor Mills (S. P. I. No. 49027). On the pods, as on the leaves, the hairiness seems more pronounced in *L. stipulacea* than in *L. striata*. (Magnified 4 diameters)

According to this note,¹² in 1886 the Australian Government, through the British Embassy at Tokyo, requested a large quantity of seed of yahazuso from the Japanese Government. The Japanese department of agriculture collected seed and planted about an acre near Tokyo. S. Harada, who was in charge of the planting, noticed that there were two kinds of plants involved, one with the leaves more rounded than those of the common yahazuso, and he named this the maruba-yahazuso. Data regarding the plant were submitted to

¹⁰ Debeaux, O. Contributions à la flore de la Chine. Florule de Tchefou (province du Chantong). In Actes Soc. Liun. Bordeaux, sér. IV, t. 1, p. 144. 1876.

¹¹ Makino, T. Observations on the flora of Japan. In Bot. Mag. Tokyo, v. 28, p. 107. 1914.

— Maruba-Yahazuso (*Lespedeza striata* Hook. et Arn. var. *stipulacea* Makino). In Bot. Mag. Tokyo, v. 8, p. 129-130. 1894. [In Japanese.]

¹² Doctor Tanaka, of the Office of Crop Physiology and Breeding Investigations, Bureau of Plant Industry, translated the gist of the article.

that department of agriculture and were published in a report of the bureau of stock farming.

DIFFERENCES BETWEEN JAPANESE AND KOREAN LESPEDEZA

In view of the value of Japanese lespedeza as a forage plant in the Southeastern States and the lack of knowledge of this closely related species, it seems advisable to call attention to the differences between these plants.

A key to the species follows:

- Leaflets usually one-half as broad as long; stipules about one-half as broad as long; pods 2 to 2.25 millimeters long (including calyx. 3 millimeters; see fig. 10); calyx lobes acute, generally covering three-fourths or more of the pod.....*L. striata*.
- Leaflets usually three-fourths as broad as long; stipules three-fourths as broad as long; pods 3 millimeters long (including calyx, 4 millimeters; see fig. 11); calyx lobes obtuse, generally covering about one-half the pod.....*L. stipulacea*.

